

Assessing vegetation condition changes using all available Landsat data

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Vegetation Condition Changes: What are we interested in measuring?

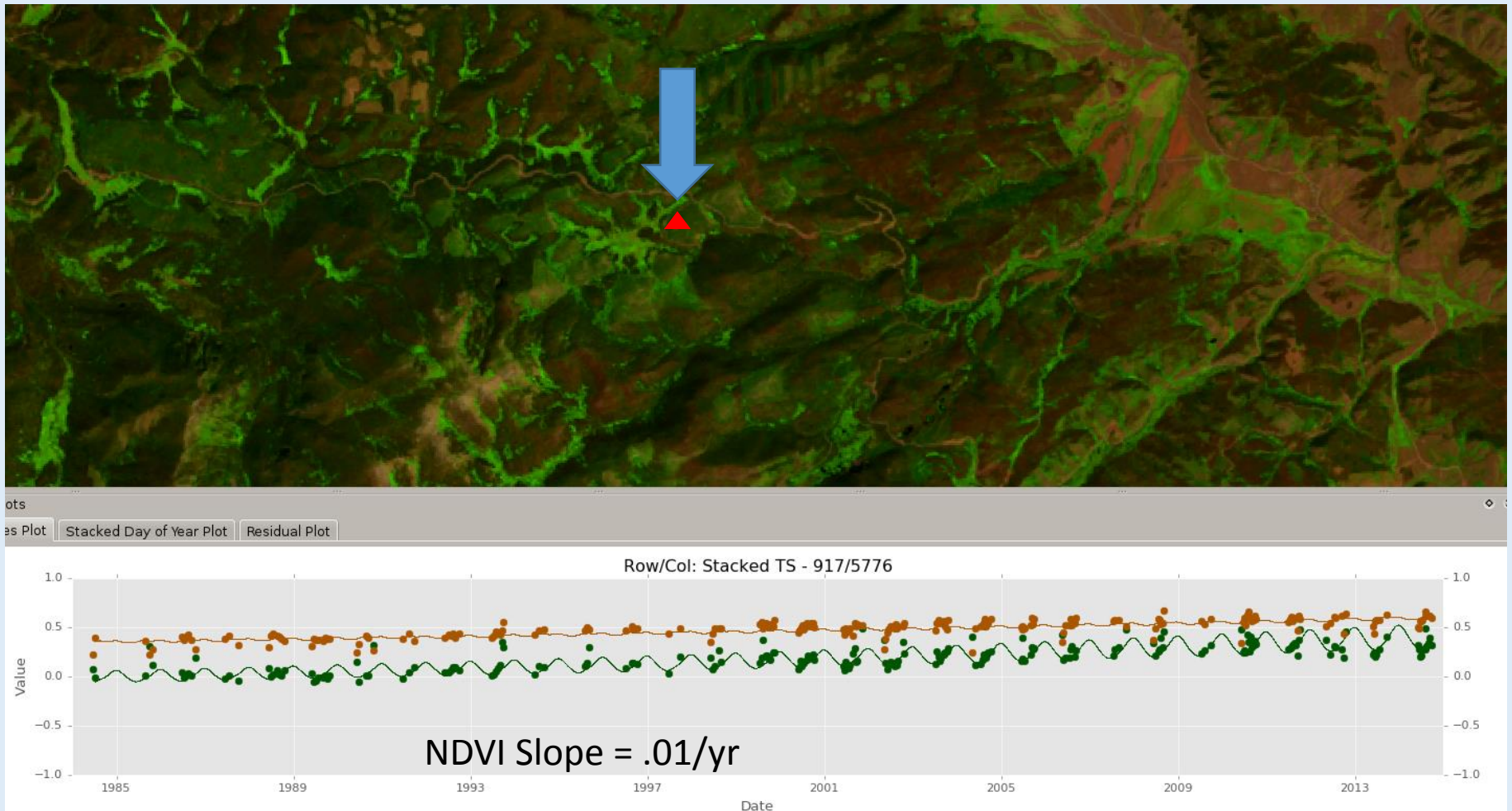
- Here we are concerned with changes that relate to changes in health of vegetation
 - Mostly not related to land cover conversion events
 - Mostly “intra-state” changes
 - Tend to be observable along a spectral continuum

A few considerations:

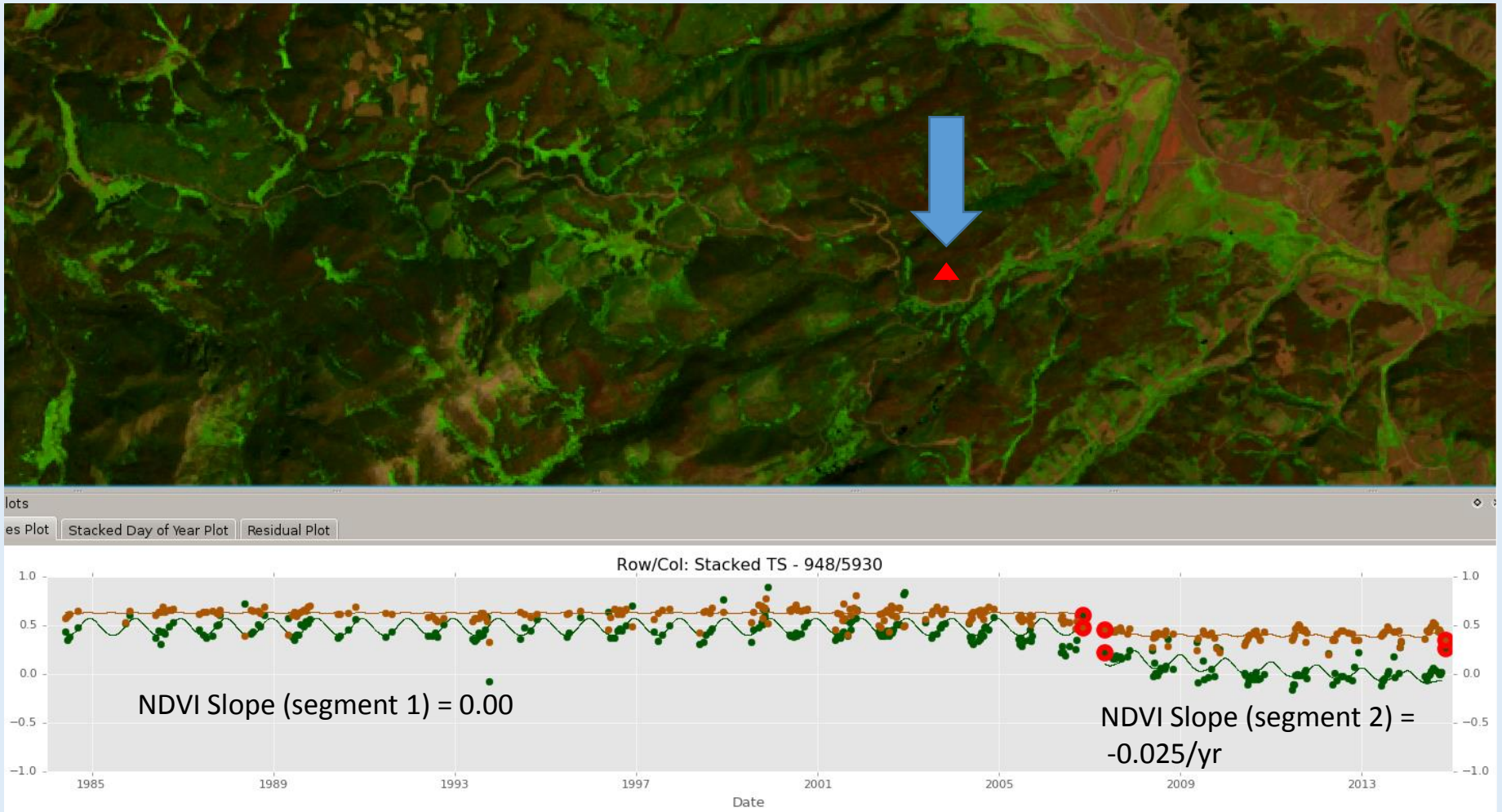
- Vegetation condition is constantly changing
 - Vegetation growth
 - Greening/senescence
 - Declines caused by climate or insects/disease or overgrazing....
- One of the best ways to make inferences about vegetation condition and condition changes is through time series observations

A number of ways to assess vegetation condition using multi-temporal data

- Slope of the trend lines
- Number of statistical breaks in the time series
- Timing of the statistical breaks
- Magnitude of the spectral change between breaks points
- Duration of each segment between breaks
- Phenology metrics (most appropriate for high temporal frequency data)
- Variability measures (including statistical significance of the trends)



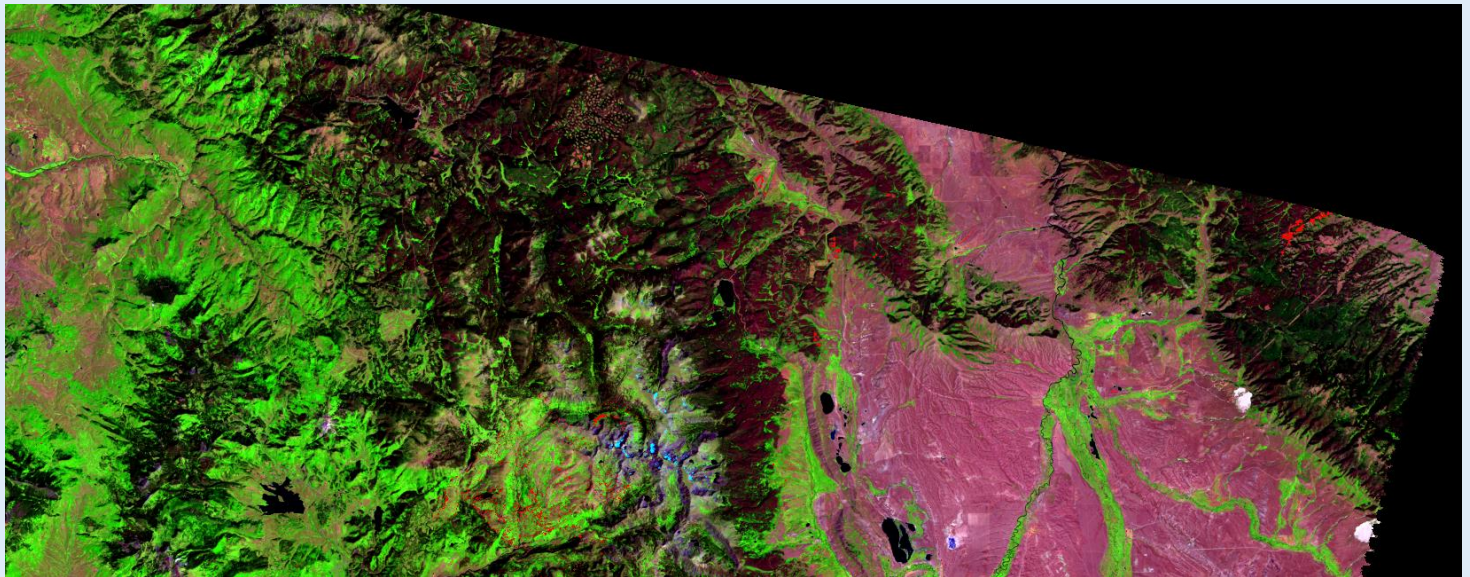
Conifer forest growth; NDVI is green trend; NBR is orange trend



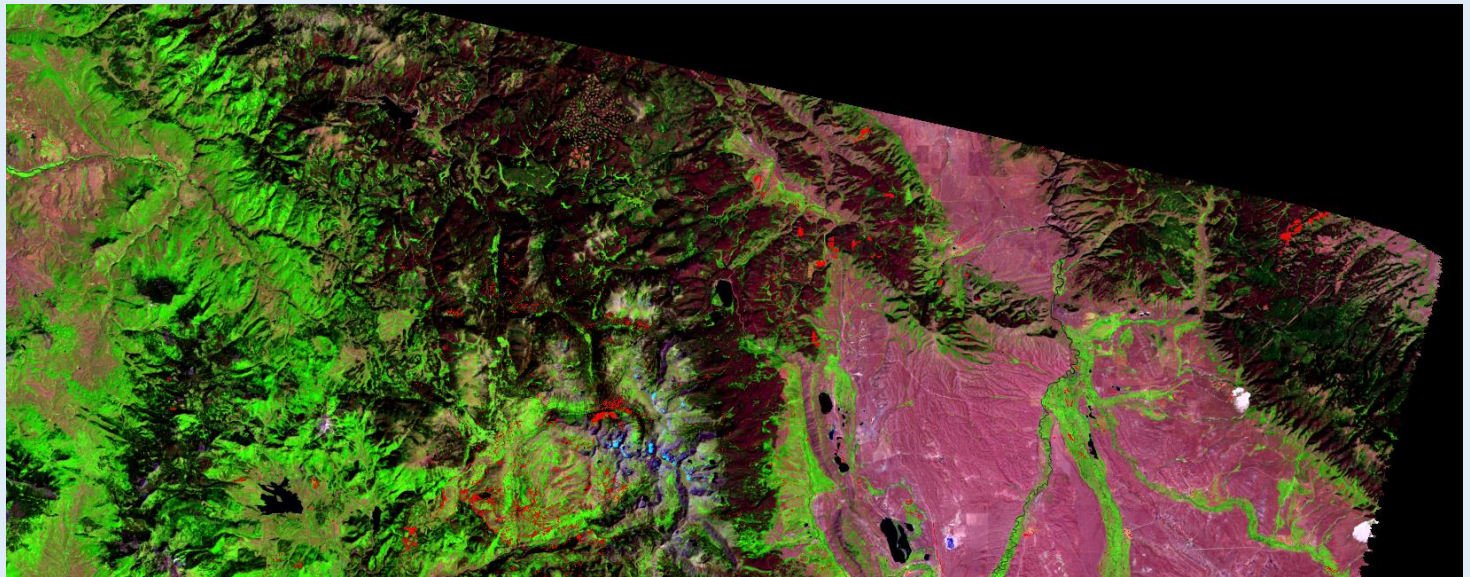
Beetle damage; green = NDVI, orange=NBR
Note that there was just one break from 1985 until 2014. This is rather typical for the beetle infestation areas for the region

What do we get if we simply map when and where the statistical breaks occur?

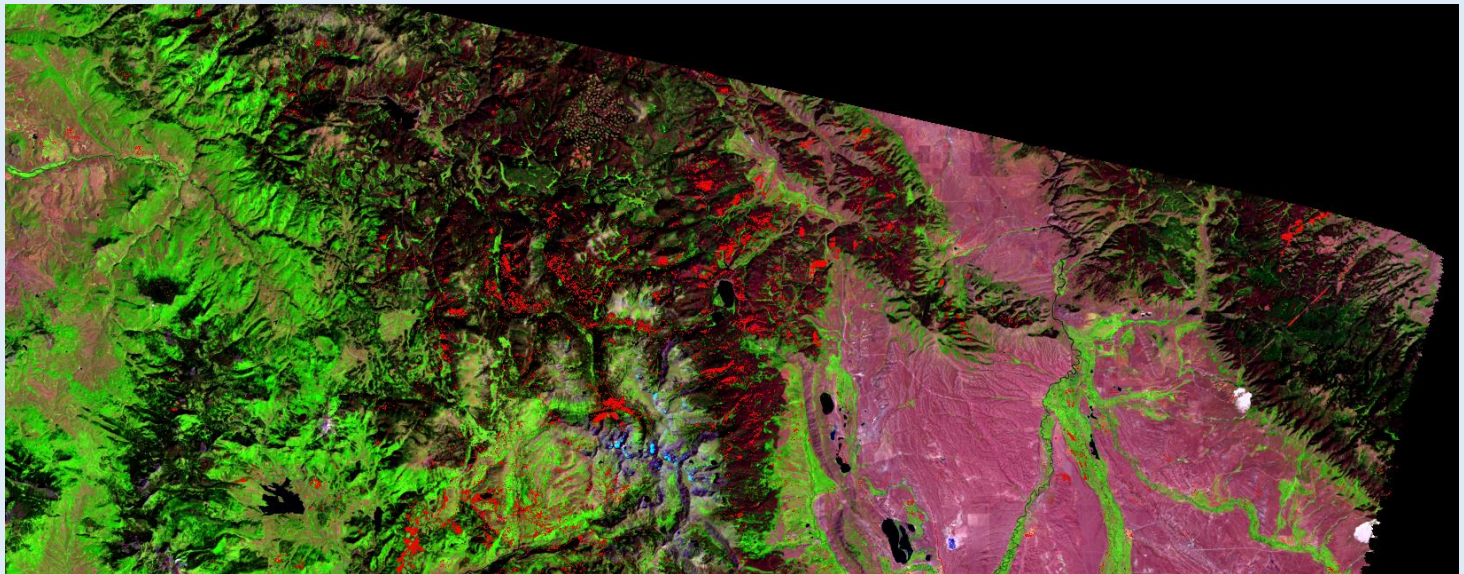
Red = CCDC Statistical Breaks in 2003



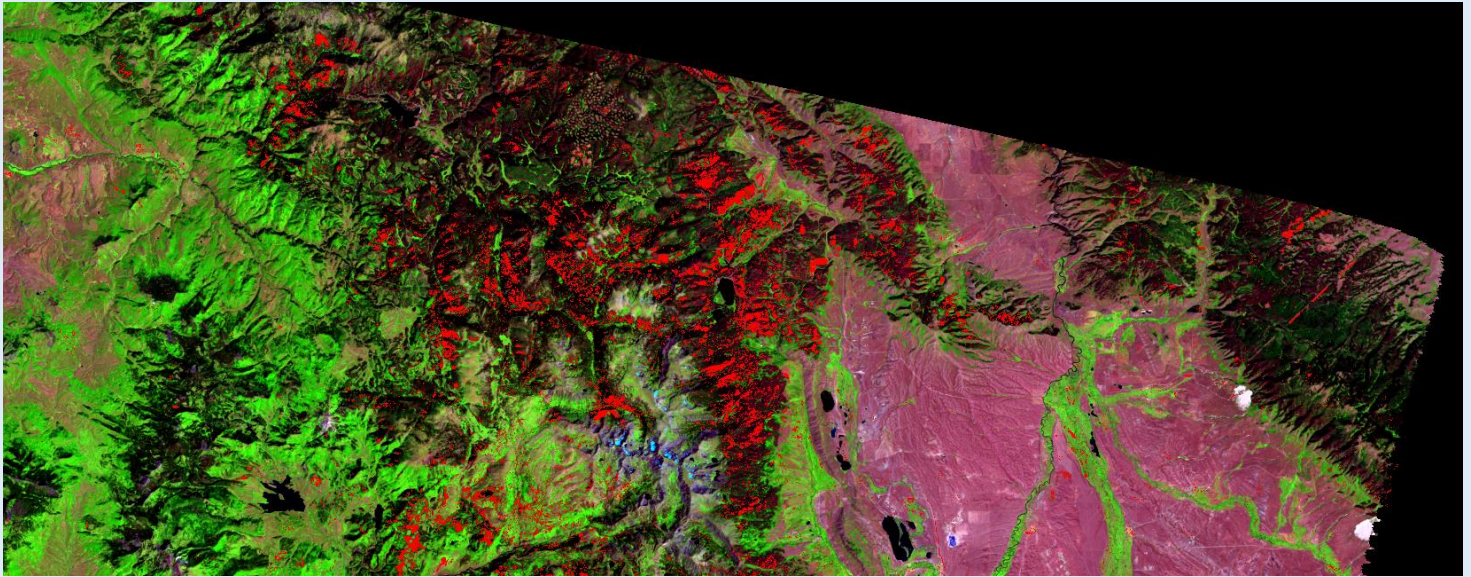
Red = CCDC Statistical Breaks in 2003, 2004, or
2005



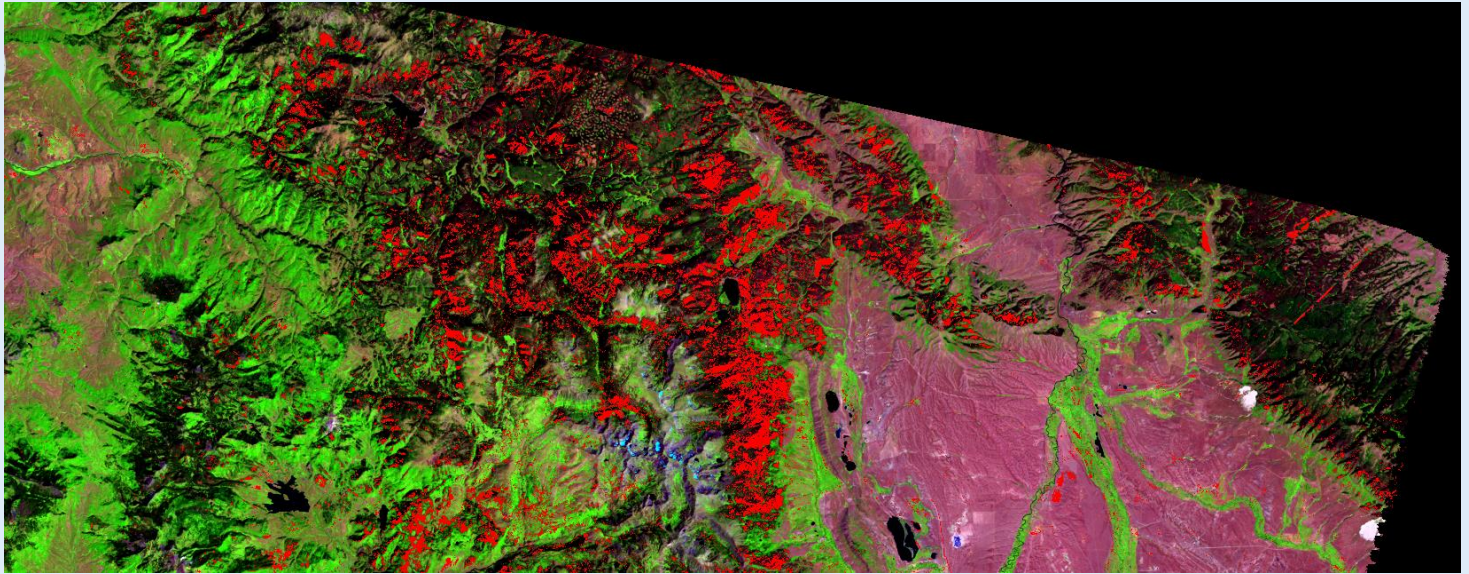
Red = CCDC Statistical Breaks in 2003, 2004,
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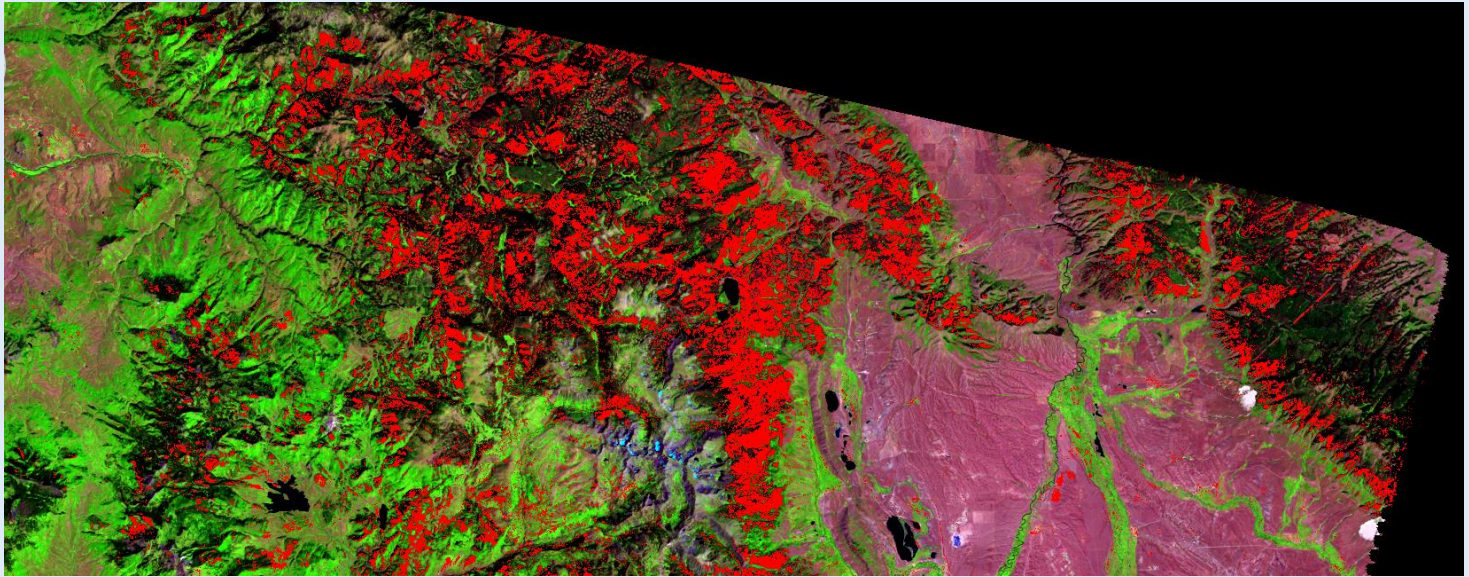
Red = CCDC Statistical Breaks in 2003, 2004,
2005, 2006, or 2007



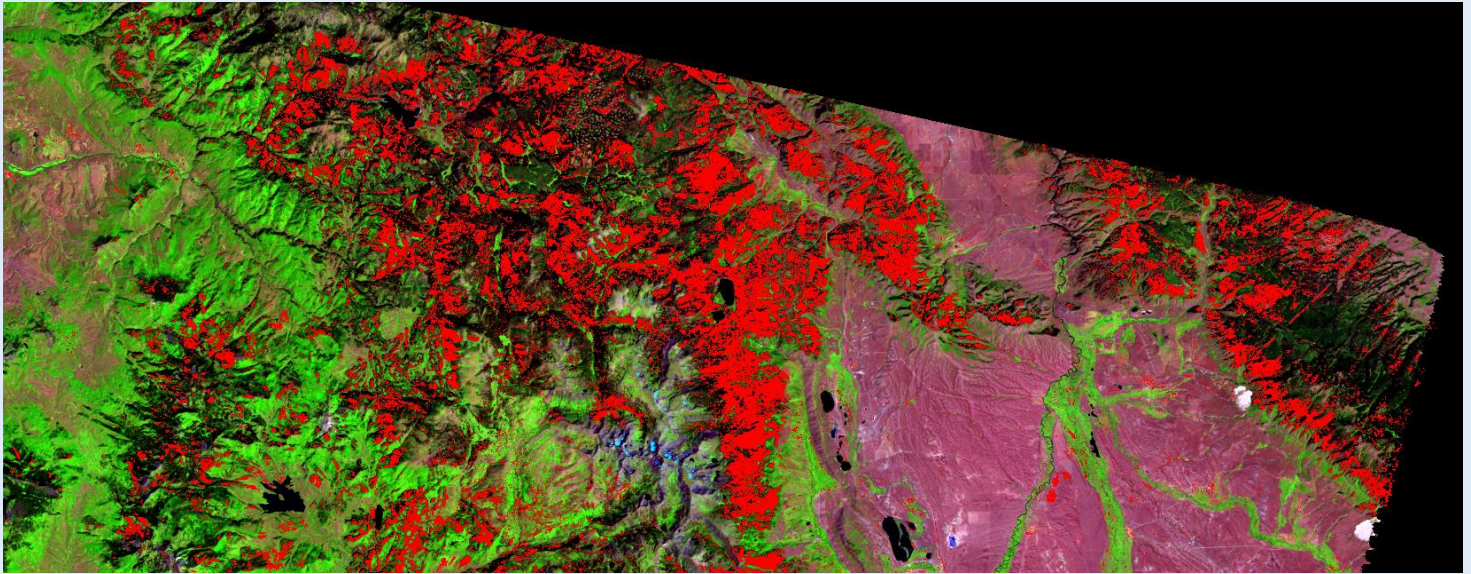
Red = CCDC Statistical Breaks in 2003, 2004,
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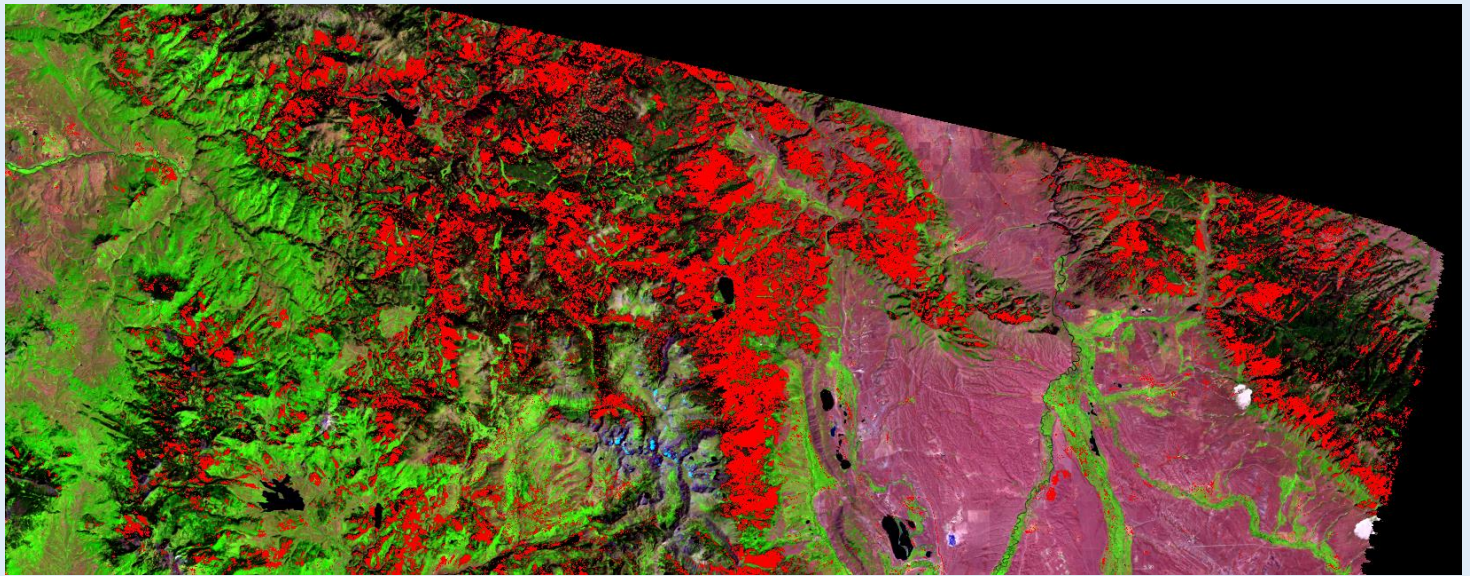
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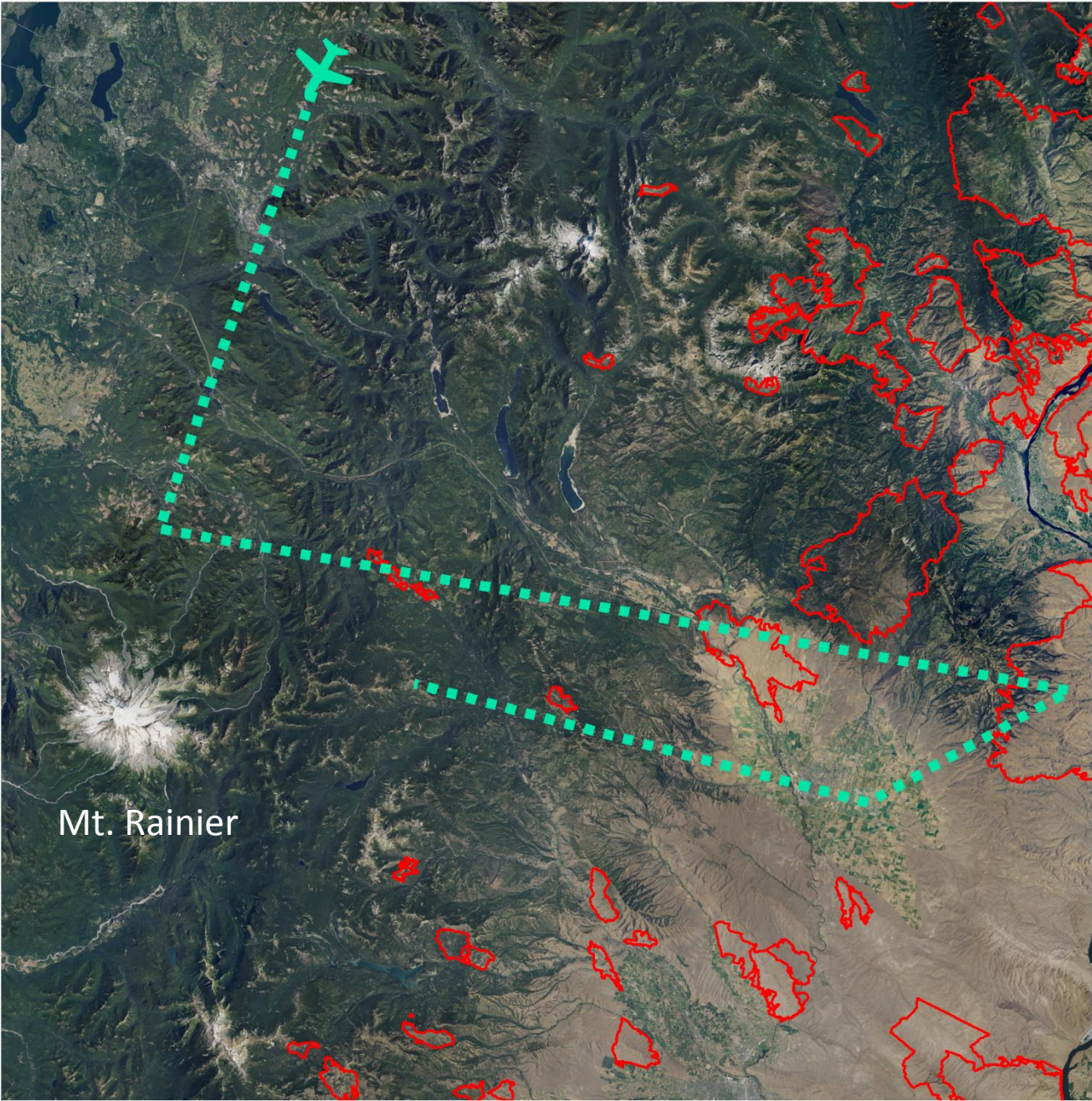


Red = CCDC Statistical Breaks in 2003, 2004,
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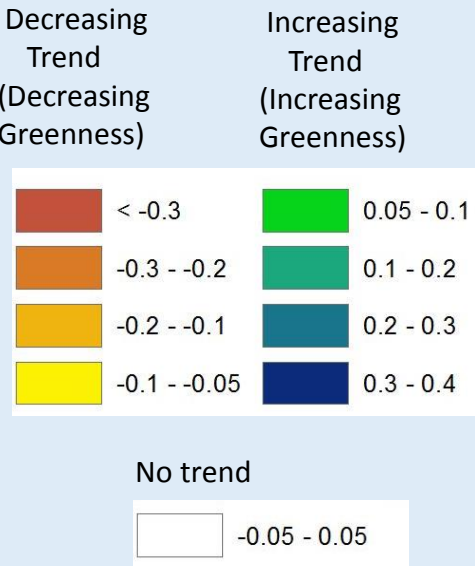
This is really easy to do if you have lots of data and a system that enables easy access and analysis!

Washington State Image with “Flight” Path for Upcoming Animation



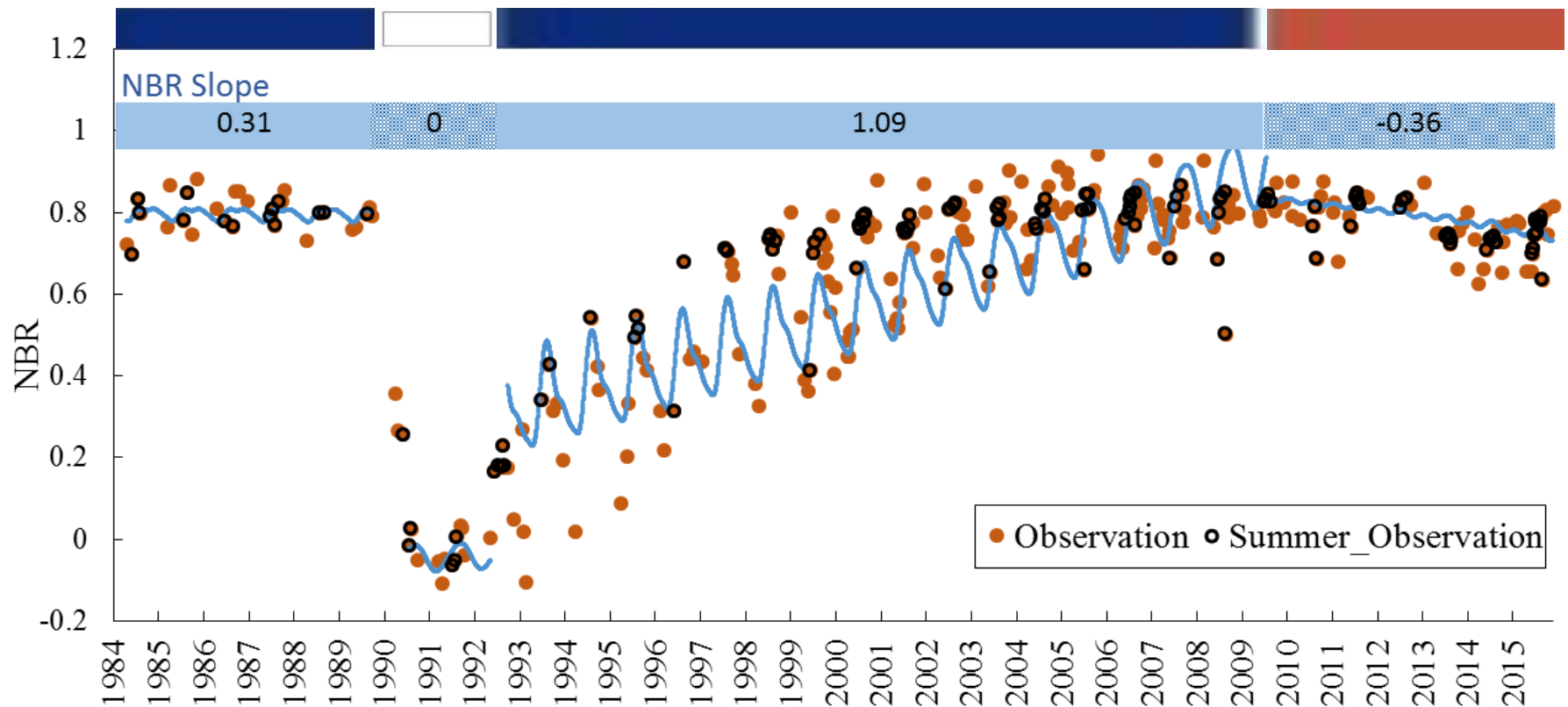
Mt. Rainier

Legend for upcoming animation

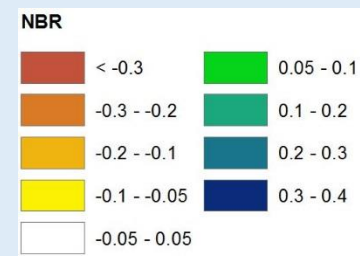
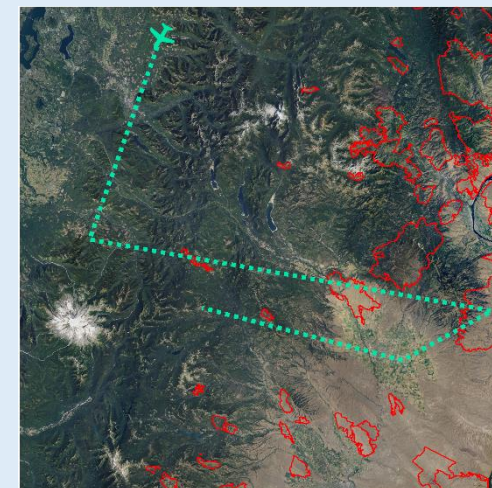
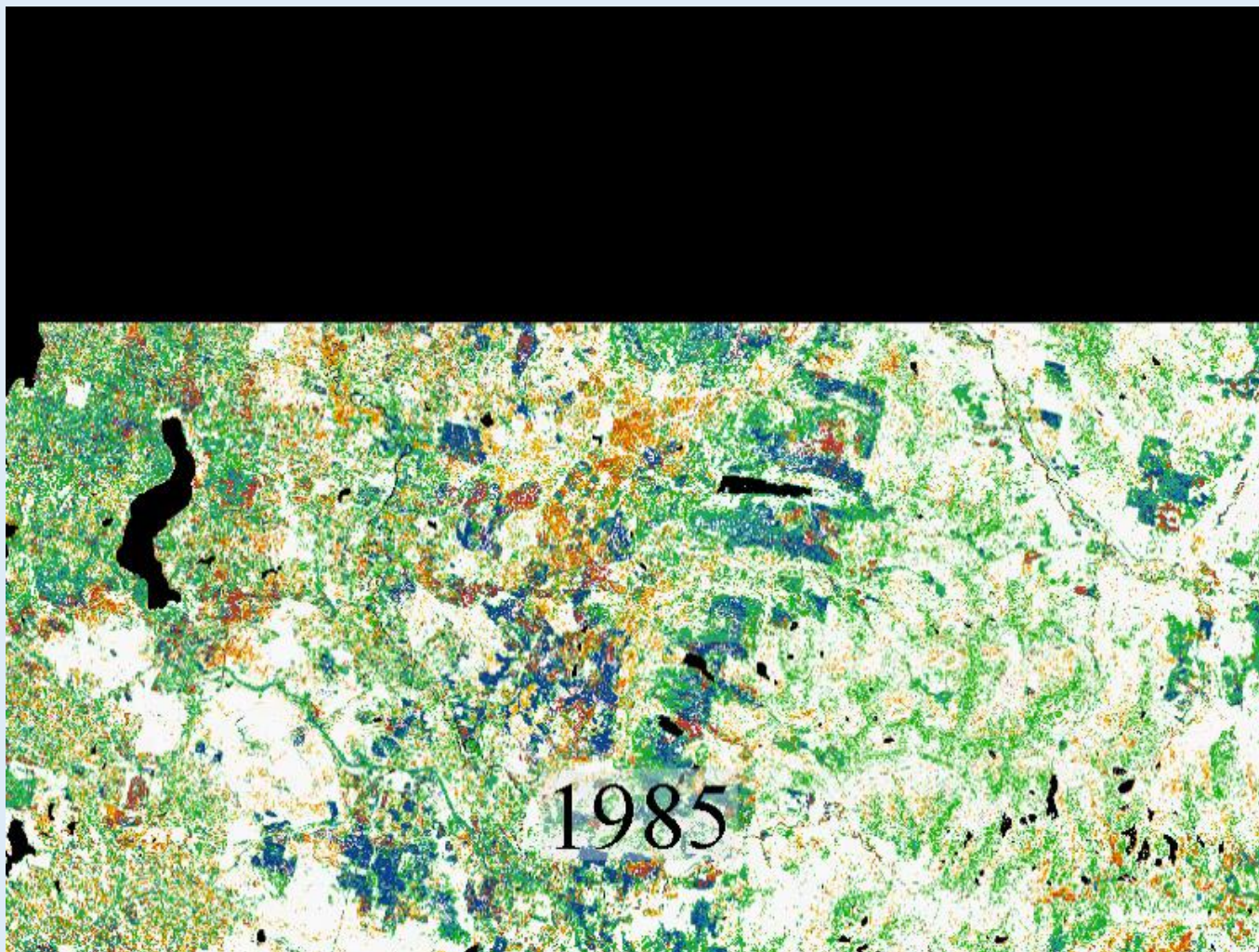


Example of NBR pixel Illustrating 30-Year Trend Pattern

NBR with CCDC fit

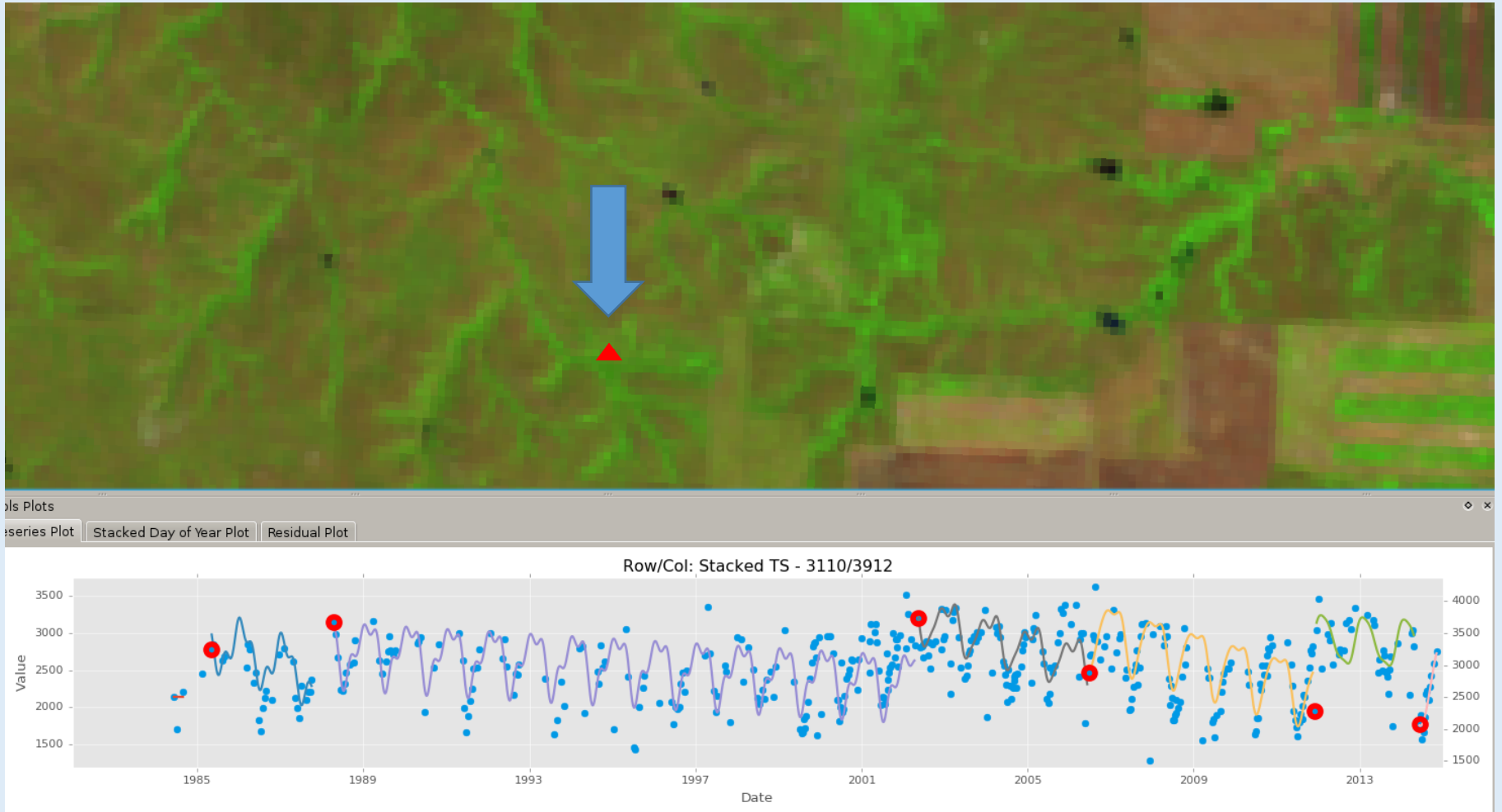


We are using just summer observations to calculate slope



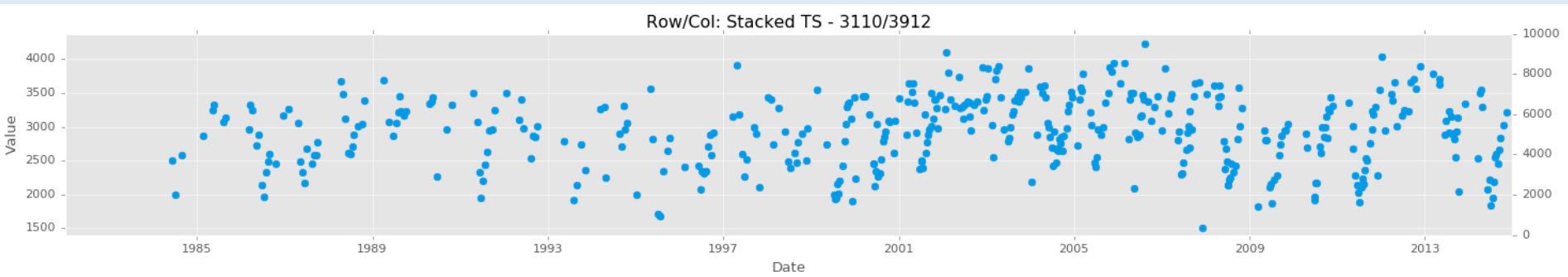
Some Key Lessons

- Our landscapes are very dynamic. Changes are related to:
 - Natural and anthropogenic events
 - Land history plays an important role
- Use of many Landsat data sets is important for providing us with a comprehensive understanding of changes taking place
- Understanding vegetation condition and changes in condition is critical to understanding the various processes taking place across our landscapes. Conversion events only tell us part of the story.
- Continuity and many multi-temporal observations are key to understanding these processes

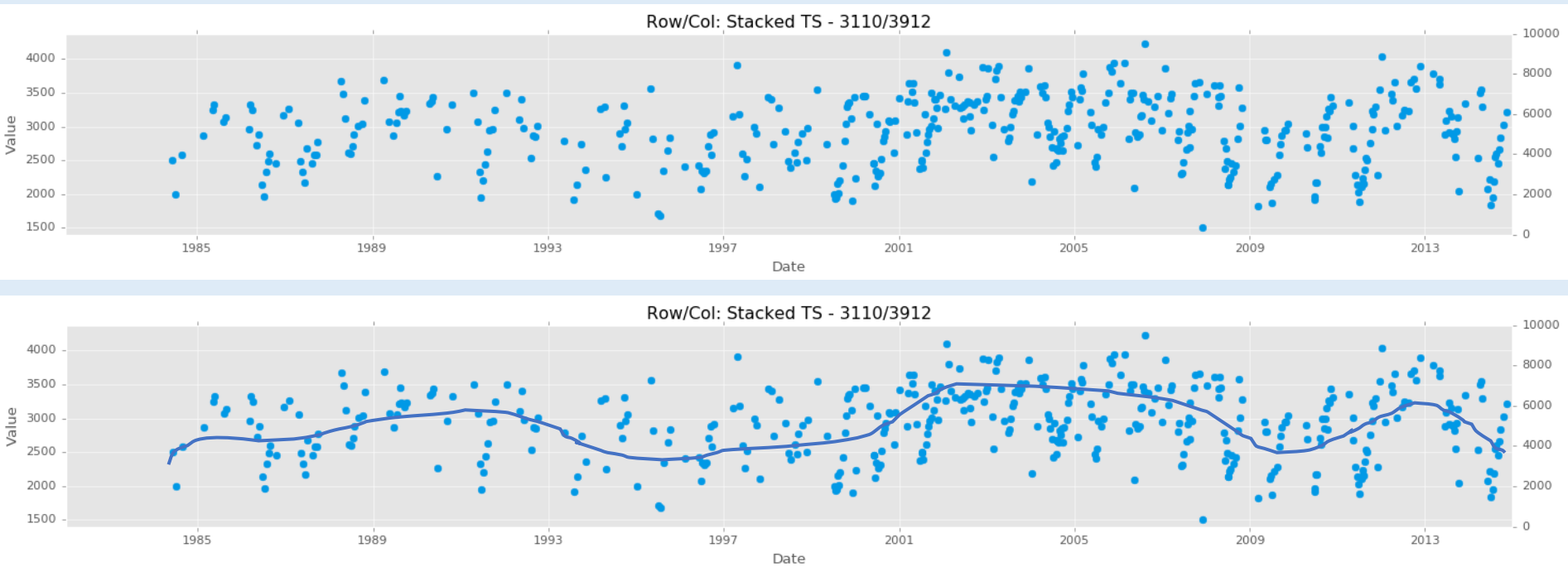


Landsat band 5 (SWIR): Are the CCDC-defined breaks the best way of portraying changes in rangelands?

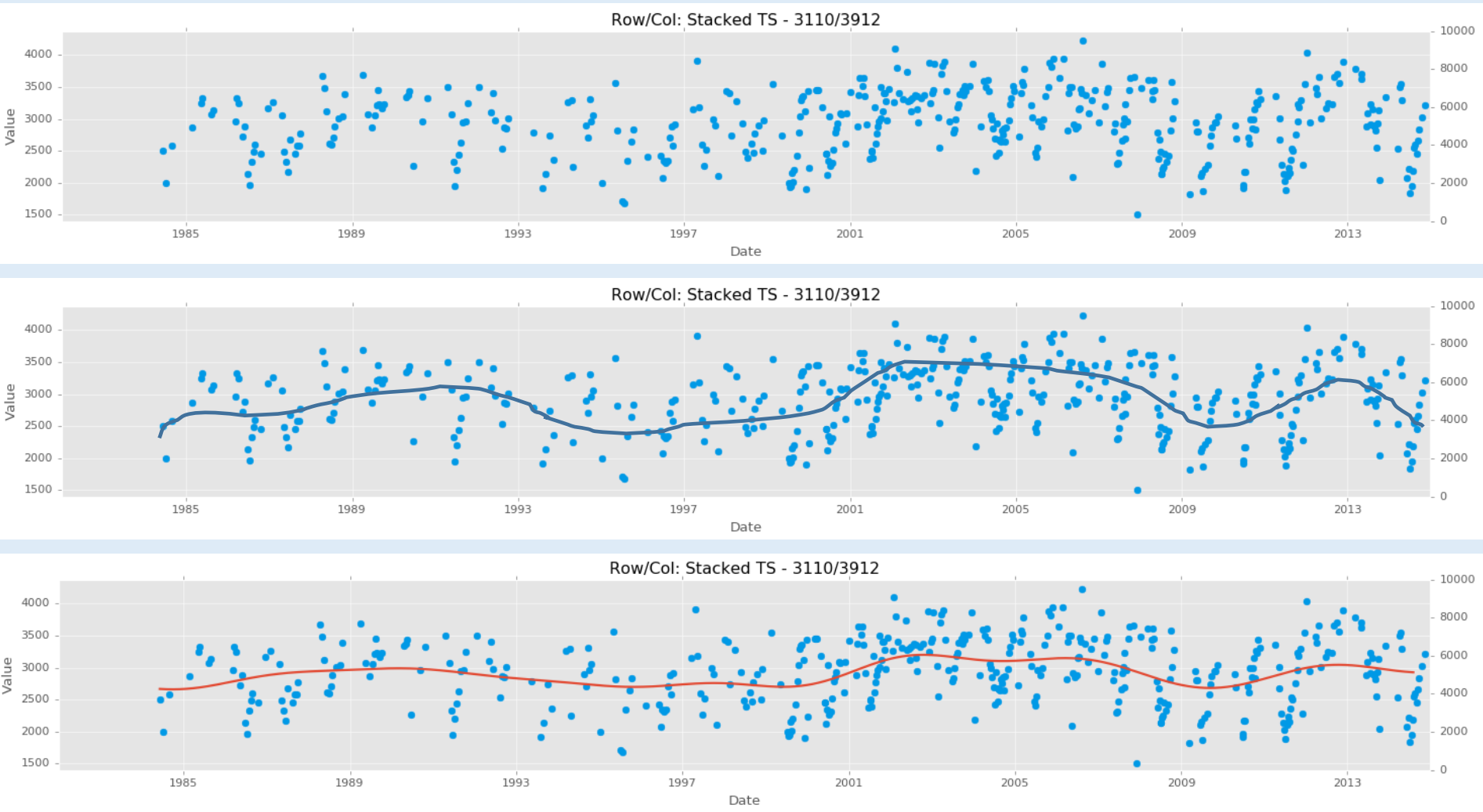
Observation

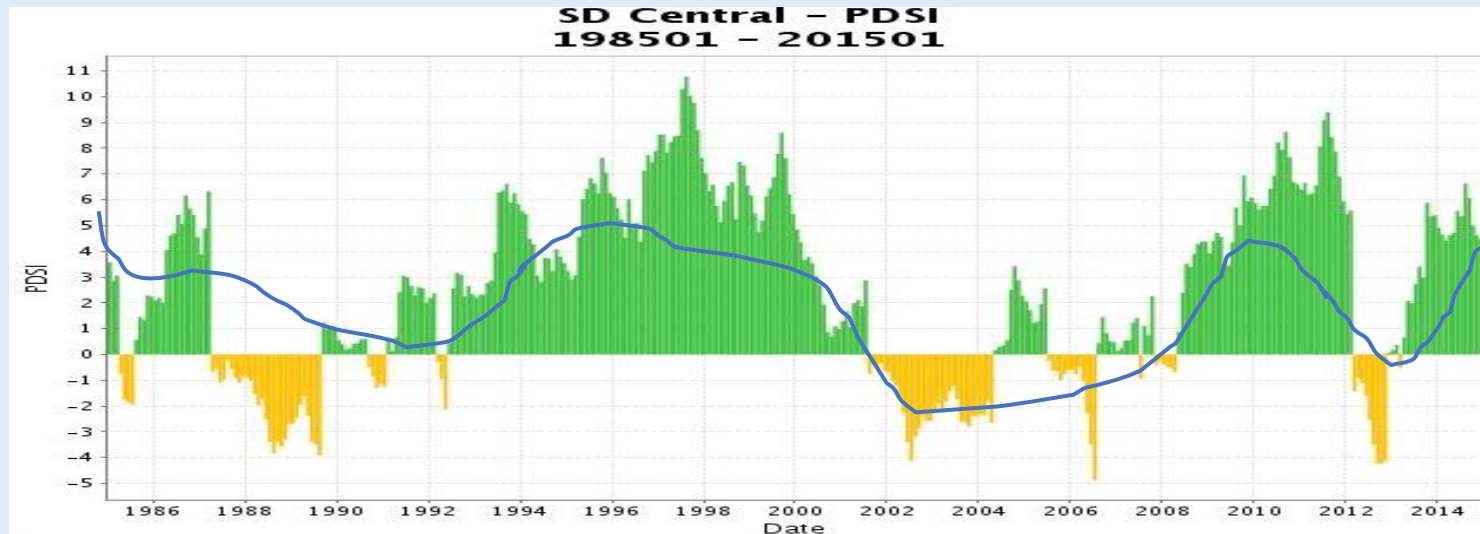


Observation



Observation





Palmer Drought Severity Index* for southwestern South Dakota with overlain inverted short-wave infrared reflectance data overlain

*PDSI; uses temperature and precipitation data to estimate relative dryness.

The story here is really one of climate/weather impacts and broad trends occurring over multiple years.

Also of note: We could not derive these patterns without lots of data.